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09/667,775	09/22/2000	Hidenori Kawanishi	717-445P	8167

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EXAMINER	
MONDT, JOHANNES P	
ART UNIT	PAPER NUMBER
2826	

DATE MAILED: 11/06/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Offic Acti n Summary	Application No. 09/667,775	Applicant(s) KAWANISHI ET AL.
	Examiner Johannes P Mondt	Art Unit 2826

-- The MAILING DATE of this communication appears n the cover sheet with the c rrespondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 October 2002*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-54* is/are pending in the application.

4a) Of the above claim(s) *21-54* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *3,5*.
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Election/Restrictions

1. Claims 21-54 have been withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in Paper No. 9.

Information Disclosure Statement

The examiner has considered the items listed in the Information Disclosure Statements of Papers No. 3 and 5.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. ***Claim 9*** is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In particular, the sentence does not have a main verb, which renders the language indefinite.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. ***Claims 1-2*** are rejected under 35 U.S.C. 102(b) as being anticipated by Ogino et al (5,907,571). Ogino et al teach a semiconductor laser device (cf. title) including a semiconductor laser chip 1 (cf. column 1, lines 12-20) and a molded resin 6 (cf. column 4, line 56 – column 5, line 23) having a light diffusion capability by virtue of the inherent property of epoxy resin and acrylic resin to scatter photons, and wherein the semiconductor laser chip is covered with the molded resin (see Figure 1).

With regard to claim 2: the semiconductor laser chip does not directly contact the molded resin (see Figure 1 and claim 1 of Ogino et al, column 8, lines 29-48).

6. ***Claims 1-3*** are rejected under 35 U.S.C. 102(b) as being anticipated by Amano et al (5,355,385).

With regard to claim 1: Amano et al teach a semiconductor laser device (cf. title) including a semiconductor laser chip 111 (cf. Figure 1 and column 3, lines 58-68) and a molded resin 9 having a light diffusion capability (inherently, by virtue of its constitution from photon-scattering material such as epoxy resin), wherein the semiconductor laser chip is covered with the molded resin 9 (cf. column 5, lines 8-26).

With regard to claim 2: the semiconductor laser chip 11 does not contact the molded resin directly (cf. column 5, lines 8-26).

With regard to claim 3: the semiconductor laser device further includes a light diffusion plate 10 (cf. column 5, lines 28-55) provided between the semiconductor laser chip and the molded resin.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. ***Claims 4 and 7*** are rejected under 35 U.S.C. 103(a) as being unpatentable over either Ogino et al (5,907,571) or Amano et al (5,355,385), in view of Claisse et al (Electronics Letters Volume 28, No. 21 (1992)). As detailed above, both Ogino et al and Amano et al anticipate claim 1. Neither Ogino et al nor Amano et al necessarily teach the further limitation of claim 4. However, the use of multiple quantum wells rather than single quantum wells or bulk wells has long been known to offer the advantage of higher yield over single quantum wells and the advantage of manufacturability at significantly higher precision and perfection than all other structural embodiments of active regions in semiconductor laser chips, as evidenced for instance by Claisse et al; see Figure 2 for the internal quantum efficiency of single quantum wells and multiple quantum wells. Specifically be referred to the greatly improved internal quantum efficiency especially for

laser lengths less than about 400 micron. Internal quantum efficiency is advantageous for any semiconductor laser chip.

Whence, the *motivation* to include the teaching by Claisse et al in this regard to the inventions taught by Ogino et al and Amano et al. The teaching by Claisse et al can be easily *combined* with the aforementioned inventions, because any modification is limited to the active layer embodiment. Therefore, *success* in the implementation of the aforementioned combination can be *reasonably expected.*

With regard to claim 7: the control that is the essence of claim 7 is inherent in the device of claim 4: spot size of an emitted light beam is inherently controllable by the size of the light-emitting portion in the semiconductor laser chip (because light is emitted over a larger or smaller area as a result of such adjustment) and the radiation angle of an emitted light beam is inherently controllable through the orientation of said light-emitting portion of the semiconductor laser chip (said orientation determines the direction of the emitting light, said direction being defined with respect to the internal coordinates of the light-emitting portion); furthermore, given their lengths the light-emitting portion can be subjected to adjustment of the intervals between them so as to control the spot size, whereas an orientational adjustment of said interval also implies control of the radiation angle; furthermore, the number or plurality of said light emitting portions, again given their individual dimensions, controls the spot size while the size, material and shape of the molded resin determines the amount of diffusion to which the laser light is exposed after leaving the semiconductor chip, said diffusion determining the path of the photons through scattering, and thus the change in spot size, whilst the

direction of the laser beam is determined by the index of refraction of said molded resin, hence on the material constitution of said molded resin. Therefore, the further limitation of claim 7 does not distinguish over the prior art.

9. ***Claim 14*** is rejected under 35 U.S.C. 103(a) as being unpatentable over Ogino et al and Claisse et al, or, in the alternative, over Amano et al and Claisse et al as applied to claim 4 above, and further in view of Hazell et al (IEEE Journal of Quantum Electronics 34 (12), pp. 2358-2363 (1998)). Although neither Ogino et al nor Amano et al nor Claisse et al necessarily mention that the plurality of light-emitting portions of the same semiconductor laser chip emit light beams of the same wavelength, usually the multiple quantum wells generally are repeating units of single quantum wells and thus generally produce light of the same wavelength and hence can be used to produce monochromatic light, for evidenced, for instance, by Hazell et al, who teach a 1.3 micron multiple quantum well laser. As an obvious method to increase the total intensity of the desired monochromatic light all multiple quantum wells could thus be designed to produce light of the same wavelength.

Motivation for inclusion of the teaching by Hazell et al in this regard is the possibility to achieve higher overall intensity of the light of a desired wavelength. *Combination* of the teaching by Hazell et al with either Ogino et al and Claisse et al or Amano et al and Claisse et al can be easily achieved by employing repeating units of single quantum wells in the implementation of the teachings by Claisse et al, which would not impact on any other design consideration in either the invention by Ogino et

al nor in the invention by Amano et al. *Success* of said combination can therefore be *reasonably expected.*

10. ***Claims 5 and 8*** are rejected under 35 U.S.C. 103(a) as being unpatentable over Ogino et al (5,907,571) in view of Hirayama et al (5,970,081), or, in the alternative, over Amano et al (5,355,385) in view of Hirayama et al (5,970,081). As detailed above, Ogino et al and Amano et al both independently anticipate claim 1. Neither Ogino et al nor Amano et al necessarily teach the further limitation of claim 5. However, in the art of semiconductor laser devices a laser chip emitting light through a light-emitting portion with a width of 18 micrometer (cf. column 6, lines 48-55), hence in the range claimed by Applicant, is standard in the art, as witnessed by Hirayama et al (see also Figure 2).

Motivation to include the teaching in this regard by Hirayama et al in the inventions of either Ogino et al or Amano et al is the consideration that, given the need for a high-power laser beam in total wattage, said need is served by having a wide light-emitting portion and also by reducing peak intensity within said laser beam as it traverses the molded resin that may inflict damage by thermal stress (cf. Ogino et al, final sentence of the abstract; and cf. Amano et al, column 5, lines 8-55). *Combination* of said teaching with the inventions is easy, because inclusion of the teaching by Hirayama et al maximally only requires the replacement of the actual laser chip by the one taught by Hirayama et al and does not impact on any of the other aspects of either Ogino et al or Amano et al. *Success* in implementing said combination can therefore be reasonably expected.

With regard to claim 8: the further limitation as defined by claim 8 is inherent in the device of claim 5: with reference to the discussion of claim 7 as given above and incorporated herein by reference, spot size and radiation angle can be controlled through adjustment of the width of the light-emitting portion irregardless of its width, and thus also for a width of said light-emitting portion of about 7 micron or more; and size, material, and dimension of the molded resin offers supplemental control through the scattering of the photons in said molded resin, whereby the spot size is increased whilst the direction of the light beam depends on the index of refraction, hence on the material constitution, of said molded resin. Therefore, the further limitation as defined by claim 8 does not distinguish over the prior art.

11. ***Claim 6, 9, and 20*** are rejected under 35 U.S.C. 103(a) as being unpatentable over Ogino et al (5,907,571) in view of Andrews (5,422,905), or, in the alternative, over Amano et al (5,355,385) in view of Andrews (5,422,905).

With regard to claim 6: As detailed above, both Ogino et al and Amano et al independently anticipate claim 1. Neither Ogino et al nor Amano et al necessarily teach the further limitation of claim 6. However, the utility of multiple beam laser diodes has previously been amply recognized, as witnessed, for instance, by Andrews (cf. column 1, lines 13-36), who teaches two closely spaced and aligned semiconductor laser chips 22 and 24 (cf. column 3, line 34-60) providing parallel beams of light (cf. Figure 8).

The invention by Andrews has applicability inter alia to optical disk readers and multi-spot printers (cf. column 1, lines 13-36) and the incorporation of the teaching by

Andrews in this regard in the inventions by Ogino et al and Amano et al is *motivated* by enlarging the technology range to which said inventions can be applied. *Combination* of said teaching with said inventions is easily accomplished by aligning another laser chip with the one already in place. *Success* in the implementation is thus *reasonable to expect.*

With regard to claim 9: as detailed above, claim 9 is subject to a rejection under U.S.C. 112, second paragraph. To the best of the examiner's ability to understand the claim, however, the following art rejection is made: the further limitation as defined by claim 9 is inherent in the device of claim 6: with reference to the discussion of claim 7 as given above and incorporated herein by reference, spot size and radiation angle can be controlled through adjustment of the width of the light-emitting portion; and size, material, and dimension of the molded resin offers supplemental control through the scattering of the photons in said molded resin, whereby the spot size is increased whilst the direction of the light beam depends on the index of refraction, hence on the material constitution, of said molded resin. Therefore, the further limitation as defined by claim 9 does not distinguish over the prior art.

With regard to claim 20: Andrews teaches the semiconductor laser chips 30 to be arranged in parallel (see Figure 8 and abstract). Motivation for inclusion of the teaching by Andrews in this regard into the inventions by Ogino et al and Amano et al is the obvious advantage of having parallel beams at one's disposal, for instance for optical disk reading and printing applications.

12. ***Claims 10-11*** are rejected under 35 U.S.C. 103(a) as being unpatentable over Ogino et al (5,907,571) in view of Okuda (6,049,423), or, in the alternative, over Amano et al (5,355,385) in view of Okuda (6,049,423). As detailed above, both Ogino et al and Amano et al anticipate claim 1. Neither Ogino et al nor Amano et al necessarily teach the further limitation of claims 10-11, although Ogino et al does teach the joint use of epoxy and silica resin at least within the device. However, the mixture of resins of different refractive indices so as to bring about enhanced light diffusion has long been practiced in the art of light-emitting devices, as exemplified by Okuda, who teaches the mixing of acrylic resin of index 1.53 with glass or silica resin of index 1.535 for the specific purpose of forming a light diffusion layer 16 (cf. column 4, lines 23-47).

Motivation to include the teaching by Okuda in this regard in the invention by Ogino et al stems from the purpose as stated by Ogino et al to reduce the light intensity (cf. abstract), and the motivation to include said teaching in Amano et al stems from the stated purpose by Amano et al to prevent undue damage to the encapsulating resin by reducing the local light intensity. *Combination* of said teaching with both inventions is easy: only the material constitution of the resin needs to be changed. *Success* in the implementation of said combination can therefore be *reasonably expected.*

13. ***Claims 12-13*** are rejected under 35 U.S.C. 103(a) as being unpatentable over either Ogino et al (5,907,571) or Amano et al (5,355,385), in view of either Andrews (5,422,905) and Brooks et al (6,049,125), or in view of Missaggia et al (IEEE Journal of Quantum Electronics <u>25</u> (9), pp. 1988-1992 (1989)). As detailed above, both Ogino et al

and Amano et al anticipate claim 1. Neither Ogino et al nor Amano et al necessarily teach the further limitation of claim 12. However, as evidenced by Andrews, it is well known in the art of semiconductor laser diode technology to contain the laser diode or diodes in a heat sink 38 (cf. column 3, lines 60-69) made of high thermal conductivity material such as copper, metallized beryllia (BeO), silicon, or diamond. In the case of copper the thermal conductivity is approximately 390 W/m.K. Therefore, the relevant length scale obtained by dividing the relevant surface area by the thickness of the copper that corresponds to the limit of 100 K/W for the thermal resistance as indicated by the further limitation of claim 13 is the common value of approximately 1 mil or greater for said relevant length scale. That this thickness range is in fact common is illustrated by Brooks et al who teach heat sink thicknesses in the range of between 5 and 10 mil (cf. column 3, lines 24-31), hence amply over 1 mil and certainly satisfying the weaker limitation of claim 12.

Motivation to include the teachings of Andrews and Brooks in this regard in either the invention of Ogino et al or Amano et al stems from the improved heat conductance of the semiconductor laser device. Because only given the material choice only the selection of the thickness of the heat sink needs to be selected, - and may be selected out of a wide range, said teachings can be easily *combined* with either Ogino et al or Amano et al; *success* in the implementation of said teachings can therefore be *reasonably expected.*

In the alternative, Missaggia et al teach a microchannel heat sink that contains a semiconductor diode laser array by virtue of the latter being bonded to it (cf. title and

caption of Figure 1), with a value of 0.04 deg/W per unit area in square cm (cf. page 1990, second column). A 15 degree rise in temperature for a power of 80W (cf. page 1991, second column) in indicated, given the reported density of laser diodes in the array; which is below the upper limit in the further limitation of claim 12.

Motivation to include the teaching by Missagia et al in this regard in the inventions by Ogino et al or Amano et al stems from the improved heat extraction offered through the microchannel heat sink as invented by Missaggia et al. The teaching by Missagia et al can be easily *combined* with either Ogino et al or Amano et al by planting the laser device on top of the heat sink plate of Missaggia et al as indicated in Figure 1 without any further impact on other aspects of the inventions. *Success* in implementing the combination can thus be *reasonably expected.*

Moreover, applicant fails to show in his disclosure that the range as indicated in claim 12 or the approximate value that is indicated in claim 13 (for the thermal resistance) is *critical to the invention.* Applicant is reminded that it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

14. ***Claims 15 and 17*** are rejected under 35 U.S.C. 103(a) as being unpatentable over either Ogino et al and Andrews or, in the alternative, over Amano et al and Andrews as applied to claim 6 above, and further in view of Sarraf (5,625,402).

With regard to claim 15: As detailed above, claim 6 is unpatentable over either Ogino et al in view of Andrews or over Amano et al in view of Andrews. None (Ogino et al, Amano et al, Andrews) necessarily teach the further limitation of claim 15. However, Sarraf teaches a plurality of laser diode arrays, each member of the same laser diode array having the same wavelength (cf. claim 1 of Sarraf, column 13, lines 27-54) (different arrays having possibly different wavelengths).

Motivation to include the teaching in this regard by Sarraf in the inventions of either Ogino et al or Amano et al is the increased power derived from a plurality rather than a single laser without concentrating too much thermal waste in a confined area, especially in view of the purpose of Ogino et al to deal with adverse consequences on the resin from the thermal expansion brought on by the heat production due to the laser light (cf. column 2, lines 49-65), and in view of the purpose of Amano et al to avoid damage to the encapsulating layer from the laser light (cf. column 5, lines 28-55). *Combination* of the teaching in this regard by Sarraf and either the invention essentially taught by Ogino et al and Andrews or Amano et al and Andrews is easily accomplished by selecting the same wavelength for the dual laser diodes as taught by Andrews. Nothing else would have to be changed. *Success* in the implementation of said combination can therefore be *reasonably expected.*

With regard to claim 17: Because different arrays of laser diodes emit light of a different wavelength (cf. title and abstract) for color printing applications (cf. column 1, lines 13-54) the further limitation of claim 17 does not distinguish over the prior art either.

Motivation to include the teaching in this regard by Sarraf into the inventions by Ogino et al or Amano et al stems from the advantage thereby accrued of being able to apply the diode array as essentially taught by Ogino et al and Andrews, or in the alternative, the diode array as essentially taught by Amano et al and Andrews, to the field of color printing. Except for varying the wavelength among the diodes no design implication would complicate the *combination* of said teaching and said inventions. *Success* in the implementation of said combination can therefore be *reasonably expected.*

15. ***Claims 16 and 18-19*** are rejected under 35 U.S.C. 103(a) as being unpatentable over either Ogino et al and Claisse et al or Amano et al and Claisse et al as applied to claim 4 above, and further in view of Kudo et al (ISBN: 0-85296-697-0). As detailed above, claim 4 is unpatentable over Ogino et al in view of Claisse et al, and also over Amano et al in view of Claisse et al. Ogino et al, Claisse et al and Amano et al do not necessarily teach the further limitation of claim 16. However, for the specific purpose of achieving an *expansion of the* wavelength band covered by the semiconductor laser chip Kudo et al teach multiple quantum well layers within the same multiple quantum well to emit different wavelengths depending on their lengths, thus covering the spectral range comprising the range between 1.44 micron and 1.59 micron (cf. title, abstract, first sentence, and page 50, third paragraph).

Motivation to include the teaching by Kudo et al in this respect in the inventions by Ogino et al and Amano et al stems from the circumstance that aforementioned

expansion is useful for applications to the increase of optical communication system transmission capacity (cf. Introduction), to which the inventions by Ogino et al and Amano et al could thus be advantageously applied. *Combination* of the teaching in this respect by Kudo et al with the inventions by Ogino et al and Amano et al is easily accomplished by variation of the length of the quantum wells within the multiple quantum well structure, which does not impact on any other design consideration. *Success* in implementing said combination can therefore be *reasonably expected.*

With regard to claims 18-19: the wavelength of the light beam emitted by the semiconductor laser chip of Kudo et al is indeed selected from the vicinity of about 1.4 micron (cf. page 50, third paragraph) as well as from a vicinity of 1.5 micron (loc. cit.); therefore, the further limitations of claims 18-19 do not distinguish over the prior art either.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Johannes P Mondt whose telephone number is 703-306-0531. The examiner can normally be reached on 8:00 - 18:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan J Flynn can be reached on 703-308-6601. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

JPM
November 2, 2002

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